

WHAT IS CLAIMED IS:

1. A sound image localization apparatus provided with a sound signal of n (n is an integer not less than 2) sampling frequencies f_1 to f_n (each frequency satisfies $f_{m-1} < f_m$ ($m = 2$ to n) and f_m is a multiple of f_1) for carrying out sound image
5 localization, said apparatus comprising:

an input sampling frequency detector for detecting the sampling frequency of said sound signal;

a basic sound image localizer that operates at said sampling frequency f_1 and carries out sound image localization on a signal
10 within a frequency band that is lower than a Nyquist frequency of the sampling frequency f_1 ;

a plurality of sound image localizers that operate at said sampling frequency f_m and carry out sound image localization on a signal within a frequency band between a Nyquist frequency of
15 said sampling frequency f_{m-1} and a Nyquist frequency of the sampling frequency f_m ;

a frequency band decomposing part for decomposing, based on a detection result of said input sampling frequency detector, said sound signal into signals of the frequency bands covered by
20 said basic sound image localizer and said plurality of sound image localizers; and

a plurality of frequency band reconstructing parts for reconstructing, based on the detection result of said input

sampling frequency detector, the signals outputted from said
25 basic sound image localizer and said plurality of sound image
localizers for each output channel.

2. A sound image localization apparatus provided with a
sound signal of n (n is an integer not less than 2) sampling
frequencies f_1 to f_n (each frequency satisfies $f_{m-1} < f_m$ ($m = 2$ to
 n) and f_m is a multiple of f_1) for carrying out sound image
5 localization, said apparatus comprising:

an input sampling frequency detector for detecting the
sampling frequency of said sound signal;

a basic sound image localizer that operates at said sampling
frequency f_1 and carries out sound image localization on a signal
10 within a frequency band that is lower than a Nyquist frequency
of the sampling frequency f_1 ;

a plurality of sound image localizers that operate at said
sampling frequency f_m and carry out sound image localization on
a signal within a frequency band between a Nyquist frequency of
15 said sampling frequency f_1 and a Nyquist frequency of the sampling
frequency f_m ;

a frequency band decomposing part for decomposing, based
on a detection result of said input sampling frequency detector,
said sound signal into signals of the frequency bands covered by
20 said basic sound image localizer and said plurality of sound image
localizers; and

a plurality of frequency band reconstructing parts for reconstructing, based on the detection result of said input sampling frequency detector, the signals outputted from said
25 basic sound image localizer and said plurality of sound image localizers for each output channel.

3. A sound image localization apparatus provided with a sound signal of n (n is an integer not less than 2) sampling frequencies f_1 to f_n (each frequency satisfies $f_{k-1} < f_k$ ($k = 1$ to n)) for carrying out sound image localization, said apparatus
5 comprising:

an input sampling frequency detector for detecting the sampling frequency of said sound signal;

a basic sound image localizer that operates at a sampling frequency f_0 , which is a divisor of said sampling frequency f_1 ,
10 and carries out sound image localization on a signal within a frequency band that is lower than a Nyquist frequency of the sampling frequency f_0 ;

a plurality of sound image localizers that operate at said sampling frequency f_k and carry out sound image localization on
15 a signal within a frequency band between a Nyquist frequency of said sampling frequency f_0 and a Nyquist frequency of the sampling frequency f_k ;

a frequency band decomposing part for decomposing, based on a detection result of said input sampling frequency detector,

20 said sound signal into signals of the frequency bands covered by
said basic sound image localizer and said plurality of sound image
localizers; and

a plurality of frequency band reconstructing parts for
reconstructing, based on the detection result of said input
25 sampling frequency detector, the signals outputted from said
basic sound image localizer and said plurality of sound image
localizers for each output channel.

4. A sound image localization apparatus provided with a
plurality of sound signals of n (n is an integer not less than
2) sampling frequencies f_1 to f_n (each frequency satisfies $f_{m-1} <$
 f_m ($m = 2$ to n) and f_m is a multiple of f_1) for carrying out sound
5 image localization on each of said sound signals, said apparatus
comprising:

an input sampling frequency detector for detecting the
sampling frequency of said sound signal;

for each of said plurality of sound signals,

10 a basic sound image localizer that operates at said
sampling frequency f_1 and carries out sound image localization
on a signal within a frequency band that is lower than a Nyquist
frequency of the sampling frequency f_1 ;

a plurality of sound image localizers that operate at said
15 sampling frequency f_m and carry out sound image localization on
a signal within a frequency band between a Nyquist frequency of

said sampling frequency f_{m-1} and a Nyquist frequency of the sampling frequency f_m ; and

20 a frequency band decomposing part for decomposing, based on a detection result of said input sampling frequency detector, said sound signal into signals of the frequency bands covered by said basic sound image localizer and said plurality of sound image localizers,

25 a plurality of adders for adding signals outputted from said basic sound image localizers and said plurality of sound image localizers together for each frequency band and each output channel; and

30 a plurality of frequency band reconstructing parts for reconstructing, based on the detection result of said input sampling frequency detector, signals outputted from said plurality of adders for each output channel.

5 5. A sound image localization apparatus provided with a plurality of sound signals of n (n is an integer not less than 2) sampling frequencies f_1 to f_n (each frequency satisfies $f_{m-1} < f_m$ ($m = 2$ to n) and f_m is a multiple of f_1) for carrying out sound image localization on each of said sound signals, said apparatus comprising:

an input sampling frequency detector for detecting the sampling frequency of said sound signal;

for each of said plurality of sound signals,

10 a basic direction localizer that operates at said sampling frequency f_1 and carries out direction localization on a signal within a frequency band that is lower than a Nyquist frequency of the sampling frequency f_1 ;

15 a plurality of direction localizers that operate at said sampling frequency f_m and carry out direction localization on a signal within a frequency band between a Nyquist frequency of said sampling frequency f_{m-1} and a Nyquist frequency of the sampling frequency f_m ; and

20 a frequency band decomposing part for decomposing, based on a detection result of said input sampling frequency detector, said sound signal into signals of the frequency bands covered by said basic direction localizer and said plurality of direction localizers,

25 a plurality of adders for adding signals outputted from said basic direction localizers and said plurality of direction localizers for each frequency band and each output channel,

 a basic crosstalk canceller for carrying out crosstalk cancellation on the added signals outputted from said basic direction localizers; and

30 a plurality of frequency band reconstructing parts for reconstructing, based on the detection result of said input sampling frequency detector, signals outputted from any of said plurality of adders that are dedicated to said plurality of direction localizers and the signal outputted from said basic

35 crosstalk canceller for each output channel.

6. A sound image localization apparatus provided with a plurality of sound signals of n (n is an integer not less than 2) sampling frequencies f_1 to f_n (each frequency satisfies $f_{m-1} < f_m$ ($m = 2$ to n) and f_m is a multiple of f_1) for carrying out sound
5 image localization on each of said sound signals, said apparatus comprising:

an input sampling frequency detector for detecting the sampling frequency of said sound signal;

for each of said plurality of sound signals,

10 a basic direction localizer that operates at said sampling frequency f_1 and carries out direction localization on a signal within a frequency band that is lower than a Nyquist frequency of the sampling frequency f_1 ;

a plurality of direction localizers that operate at said
15 sampling frequency f_m and carry out direction localization on a signal within a frequency band between a Nyquist frequency of said sampling frequency f_{m-1} and a Nyquist frequency of the sampling frequency f_m ; and

a frequency band decomposing part for decomposing, based
20 on a detection result of said input sampling frequency detector, said sound signal into signals of the frequency bands covered by said basic direction localizer and said plurality of direction localizers,

a plurality of adders adding signals outputted from said
25 basic direction localizers and said plurality of direction
localizers for each frequency band and each output channel,

a basic crosstalk canceller for carrying out crosstalk
cancellation on the added signals outputted from said basic
direction localizers;

30 a plurality of crosstalk cancellers for carrying out
crosstalk cancellation on the added signals outputted from said
plurality of direction localizers; and

a plurality of frequency band reconstructing parts for
reconstructing, based on the detection result of said input
35 sampling frequency detector, signals outputted from said basic
crosstalk canceller and said plurality of crosstalk cancellers
for each output channel.

7. The sound image localization apparatus according to
claim 1, further comprising:

an input format discriminator for discriminating, as to
said sound signal, between a bit stream $\Sigma \Delta$ modulated by each bit
5 and a multi-bit PCM bit stream,

a decimator for down-sampling said sound signal; and

a switching part for switching, for output to said frequency
band decomposing part, to a signal outputted from said decimator
when said input format discriminator discriminates said sound
10 signal as the bit stream $\Sigma \Delta$ modulated by each bit, and to said

sound signal as it is when said input format discriminator discriminates said sound signal as the multi-bit PCM bit stream.

8. The sound image localization apparatus according to claim 2, further comprising:

an input format discriminator for discriminating, as to said sound signal, between a bit stream $\Sigma \Delta$ modulated by each bit
5 and a multi-bit PCM bit stream,

a decimator for down-sampling said sound signal; and

a switching part for switching, for output to said frequency band decomposing part, to a signal outputted from said decimator when said input format discriminator discriminates said sound
10 signal as the bit stream $\Sigma \Delta$ modulated by each bit, and to said sound signal as it is when said input format discriminator discriminates said sound signal as the multi-bit PCM bit stream.

9. The sound image localization apparatus according to claim 3, further comprising:

an input format discriminator for discriminating, as to said sound signal, between a bit stream $\Sigma \Delta$ modulated by each bit
5 and a multi-bit PCM bit stream,

a decimator for down-sampling said sound signal; and

a switching part for switching, for output to said frequency band decomposing part, to a signal outputted from said decimator when said input format discriminator discriminates said sound

10 signal as the bit stream $\Sigma \Delta$ modulated by each bit, and to said sound signal as it is when said input format discriminator discriminates said sound signal as the multi-bit PCM bit stream.

10. The sound image localization apparatus according to claim 4, further comprising:

for each of said sound signals,

an input format discriminator for discriminating, as to
5 said sound signal, between a bit stream $\Sigma \Delta$ modulated by each bit and a multi-bit PCM bit stream,

a decimator for down-sampling said sound signal; and

a switching part for switching, for output to said frequency band decomposing part, to a signal outputted from said
10 decimator when said input format discriminator discriminates said sound signal as the bit stream $\Sigma \Delta$ modulated by each bit, and to said sound signal as it is when said input format discriminator discriminates said sound signal as the multi-bit PCM bit stream.

11. The sound image localization apparatus according to claim 5, further comprising:

for each of said sound signals,

an input format discriminator for discriminating, as to
5 said sound signal, between a bit stream $\Sigma \Delta$ modulated by each bit and a multi-bit PCM bit stream,

a decimator for down-sampling said sound signal; and

a switching part for switching, for output to said frequency band decomposing part, to a signal outputted from said decimator when said input format discriminator discriminates said sound signal as the bit stream $\Sigma \Delta$ modulated by each bit, and to said sound signal as it is when said input format discriminator discriminates said sound signal as the multi-bit PCM bit stream.

12. The sound image localization apparatus according to claim 6, further comprising:

for each of said sound signals,

an input format discriminator for discriminating, as to said sound signal, between a bit stream $\Sigma \Delta$ modulated by each bit and a multi-bit PCM bit stream,

a decimator for down-sampling said sound signal; and

a switching part for switching, for output to said frequency band decomposing part, to a signal outputted from said decimator when said input format discriminator discriminates said sound signal as the bit stream $\Sigma \Delta$ modulated by each bit, and to said sound signal as it is when said input format discriminator discriminates said sound signal as the multi-bit PCM bit stream.